

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[FIFTH SERIES.]

No. 104. AUGUST 1886.

IX.—*Notes from the St. Andrews Marine Laboratory (under the Fishery Board for Scotland).*—No. V. *On the Paternal Instincts of Cyclopterus lumpus, L.* By Prof. M'INTOSH, M.D., LL.D., F.R.S., &c.

THE care which certain male Teleosteans take of the ova is well known, while Dr. Günther mentions only two cases (viz. *Aspredo* and *Solenostoma*) in which females do so. In this country the males of the river bullhead, the lumpsucker, and the marine and freshwater *Gastrostei* are familiar instances, an interesting account of *Gastrosteus spinachia*, by Mr. E. E. Prince, indeed, having but lately appeared in this journal*.

Most authors who have treated of *Cyclopterus* have observed this feature in the male†; but the interpretations placed on it have been varied, some supposing that the mere fact of the male being in the neighbourhood at deposition sufficed to account for its subsequent appearance near the eggs, while others, after Fabricius, bestowed considerable attention on the description of the instinct. In regard to the remarks of Fabricius, however, it is doubtful if the wolf-fish would be much inconvenienced by the attacks of the lumpsucker.

* Ann. & Mag. Nat. Hist. Dec. 1885, pp. 487 *et seq.*

† It is sufficient, under ordinary circumstances, to try to push them off guard with a stick to bring out this clearly.

Even in its larval condition the young *Anarrhichas* makes an easy prey of the young *Cyclopteri*.

About the middle of May a male *Cyclopterus* was found a short distance from low-water mark in a broad runlet with his head close to a mass of ova placed on the seaward edge of a stone. The stream of sea-water was so shallow as to leave the stone partly exposed, and was quite insufficient to float the fish, which was $11\frac{1}{2}$ inches in length. Accordingly, for a considerable period twice daily the devoted male had to lie in the runlet on his side, a portion of his body, including the upper opercular region (in this position) being above water. From the situation of the ova on the stone just described the current of the runlet flowed into the mouth of the fish, which, in the warm sun of June, must have been less comfortable than under ordinary circumstances, a fact which is at variance with the "accidental" theory formerly mentioned. The cool and ever-changing stream, however, sufficed for aeration, the movements of the hyoidean apparatus and the mandible, as well as the direction of the stream, causing a current over the upper as well as the lower branchiae. Thus, although the action of the branchial apparatus and the heart was occasionally a little hurried in the warm sun, no serious effect ensued. For five or six weeks this faithful male was found at low water in this position, sometimes on one side and sometimes on the other. In order to test it still further Mr. Scharff removed the fish a couple of yards from the eggs and placed it on a stone. It wriggled actively into the water, at once rushed to the ova, and assumed its former position with the snout almost touching the eggs. The same ensued when it was placed in the runlet at a somewhat greater distance. The solicitude of the males for the ova which they have under charge was further illustrated by the occurrence early in May of a heavy sea, which swept masses of the ova from their positions all along the rocks. As soon as the sea became calm numerous anxious males, like "pilgrims," were seen by the laboratory attendant (who had been familiar with the sites) seeking for their lost charges. Many of these masses of eggs were found on the beach, so that the statement is probable.

As soon as the eggs were hatched the male was released, and the young spread themselves over the rock-pools in the neighbourhood in hundreds. It is unlikely, however, that they are dispersed by specially adhering to the body of the male, though they quickly cling to anything and even to each other. Their home appears for some time to be the littoral region and especially the rock-pools, and they are occasionally

found in considerable numbers in August, when the larger examples caught with a hand-net measured about $\frac{7}{8}$ inch. They adhere to the blades of the tangles and other seaweeds, and in the mazes of these find that safety (from the ready application of their suckers) which would be denied them in the open sea. When caught in the tow-net inshore it is generally along with floating littoral seaweeds with which they have migrated.

Besides the various shades of green which characterize the young *Cyclopteri* some are beautifully variegated with touches of brown, while pale bands or streaks of silver, often symmetrically arranged, give them a striking appearance. Others again are dotted over with black points. On emerging from the eggs they swim actively through the water, the pectorals being kept in rapid vibration, and they soon become predaceous, attacking as they grow older the smaller forms of their own species as well as minute Mysidæ and other prey. The young examples caught in the rock-pools had fed on the abundant larval crustaceans, such as larval Cirripedes and Copepods. The larval fin speedily becomes differentiated into the two dorsals and the anal. The first dorsal resembles at the tenth or twelfth day the other fins, that is it is membranous, as Mr. Thompson, Prof. Alex. Agassiz*, and other observers have noted, and has six slender spines. The metamorphosis of this fin occurs subsequently.

The period of spawning at St. Andrews ranges from February to May, and this year it was especially late, probably from the severe and long-continued winter. The young captured during the first ten days of July therefore showed considerable variation in size. A feature of interest in regard to the fisheries is the fact that food-fishes and others are extremely fond of the ova of *Cyclopterus*. Thus at the end of April about one hundred fine codling were caught by the liners in St. Andrews Bay, off the rocks at Boarhills, and the stomachs of these were distended with the ova of the lumpsucker. Even such small fishes as Yarrell's blenny (*Carelophus Ascanii*) took the same food. Whether these attacks from without cause the hollows in the masses of ova (which resemble holes that have been scooped out) is unknown, but these are very common. Some perforations in the masses may have been due to their position over the apertures of *Pholas crispata*; but the former hollows were produced by other causes.

The *Cyclopteri* form no *nests*, the ova being deposited chiefly on the sides of rocks and stones. They have been very abundant this season both amongst the rocks and in the

* Proc. Amer. Acad. of Arts and Sci. vol. xvii. p. 286, pl. iv.

salmon-nets (in the latter especially in easterly gales, which rendered the water muddy) ; in one case, indeed, the net could not be pulled up off the east rocks, from the great weight of the captured lumpsuckers (estimated at several tons), and it was ruptured. They are only used along with fish-offal for manure.

Pennant's observation with regard to the tenacity with which an adult clings by its sucker to a pail full of water has been found to be quite accurate. The whole can be lifted by seizing the fish, and a greater weight than 43 pounds (which was that of pail and water) could readily be raised in this manner.

X.—*On the Presence of Oleaginous Spheres in the Yolk of Teleostean Ova.* By EDWARD E. PRINCE, St. Andrews Marine Laboratory.

OF the 9000 or 10,000 species of osseous fishes known to zoologists the eggs of not more than 80 have been obtained and determined. This comparatively small number indeed includes several species whose ova have been discovered only within the last twelve months by Prof. M'Intosh at the St. Andrews Marine Laboratory, and are therefore new to science. Quite a large proportion of these eggs are characterized by the presence in the yolk of large refringent masses, the so-called oil-globules. These structures have long been familiar to embryologists, and they constitute a prominent feature in those Salmonoids whose development is more completely known than that of any other group of Teleosteans. Yet the significance and function of these bodies seems to be little understood, or, more truly, seems to be wholly misunderstood. Of course all fish-ova have oily elements in their protoplasm, some cholesterin being constantly present, with other fatty matters, in addition to myosin and the usual derivatives of albumin; but these elements, when they can be detected optically, are microscopic, and, being distributed as minute vesicles all over the vitellus, strikingly differ from the large globules here considered. Not only in size, but in colour, situation, and relation to the rest of the ovum, and almost certainly also in chemical composition, these large spheres are distinguished from the microscopic fatty particles present in all ova. So well-marked and characteristic are